

What is claimed is:

1. A process for preparing and screening an array of metal-ligand compositions comprising:

preparing an array of polymerization mixtures in a series of discrete reaction vessels contained by or within an integrated structure, each polymerization mixture of the array comprising a polymerization monomer and a metal-ligand composition wherein different reaction vessels of the array contain different metal-ligand compositions and said preparing comprises delivering a metal-binding ligand and a dissolved, soluble metal precursor to each of the reaction vessels of the array which combine to form the metal-ligand composition;

subjecting the integrated structure to conditions conducive to the formation of a polymerization reaction product; and

screening the array for polymerization reaction product.

2. The process of claim 1 wherein the metal-ligand compositions comprise a cyclic structure having at least 5 ring members, one member being the metal of the soluble metal precursor.

3. The process of claim 1 wherein the metal-binding ligand is not bound to a solid material.

4. The process of claim 3 wherein the metal-binding ligand is delivered to the series of discrete reaction vessels after the soluble metal precursor.

5. The process of claim 3 wherein the soluble metal precursor is delivered to the series of discrete reaction vessels after the metal-binding ligand.

6. The process of claim 1 wherein the soluble metal precursor has a formula  $MR_n$ , wherein M is a transition metal, a lanthanide metal, an actinide metal, an alkali metal, an alkaline earth metal or a main group metal, R is a solublizing ligand, and n ranges from about 1 to about 8.

7. The process of claim 1 wherein the soluble metal precursor has a formula  $MR_nL_m$ , wherein M is a transition metal, a lanthanide metal, an actinide metal, an alkali metal, an alkaline earth metal or a main group metal, R is a solublizing ligand, L is a neutral solublizing ligand, n ranges from about 0 to about 8, and m ranges from about 0 to about 6, provided the sum of  $n + m$  is at least 1.

8. The process of claim 1 wherein the soluble metal precursor has a formula  $M_pR_{n'}L_{m'}$ , wherein M is a transition metal, a lanthanide metal, an actinide metal, an alkali metal, an alkaline earth metal or a main group metal, R is a solublizing ligand, L is a neutral solublizing ligand, p is greater than 1,  $n'$  and  $m'$  are each independently a number greater than 0, provided the sum of  $n' + m'$  is at least 2.

9. The process of claim 1 wherein the soluble metal precursor comprises a metal selected from Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Y, Zr, Nb, Mo, Ru, Rh, Pd, Ag, Cd, La, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, U, Th, B, Al, Ga, Tl, In, Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr, Ba, Ge, Sn, Pb, Sb, Bi or a combination thereof.

10. The process of claim 9 wherein the soluble metal precursor comprises one or more solublizing ligands independently selected from the group consisting of halogen, substituted or unsubstituted alkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted cycloalkenyl, substituted or unsubstituted heteroalkyl,

substituted or unsubstituted heterocycloalkyl, substituted  
or unsubstituted aryl, substituted or unsubstituted  
heteroaryl, alkoxy, aryloxy, hydroxy, boryl, silyl, hydride,  
10 thio, oxo, imido, sulfido, seleno, phosphino, amino,  
carboxylate, 1,3-dionate, oxalate, carbonate, nitrate,  
sulfate, perchlorate, sulfonate, phosphonate and  
combinations thereof.

11. The process of claim 1 wherein the soluble metal  
precursor comprises a solublizing ligand R and/or a neutral  
solublizing ligand L, and further wherein one or more of the  
metal-ligand compositions is formed without displacing one  
5 or more of the solublizing ligands and/or neutral  
solublizing ligands.

12. The process of claim 1 wherein the soluble metal  
precursor comprises a solublizing ligand R and/or a neutral  
solublizing ligand L, and further wherein formation of one  
or more of the metal-ligand compositions is accompanied by  
5 the displacement of one or more of the solublizing ligands  
and/or neutral solublizing ligands, said displaced ligand(s)  
not interfering with or significantly inhibiting the  
polymerization reaction.

13. The process of claim 12 wherein, prior to  
polymerization reaction, one or more of the metal-ligand  
compositions is treated to convert the displaced solublizing  
ligand, R, and/or the displaced neutral solublizing ligand,  
5 L, to a form which does not interfere or significantly  
inhibit the polymerization reaction.

14. The process of claim 1 wherein, prior to the  
screening reaction, a reactant and an activator are  
delivered to the polymerization mixture, the reactant being  
delivered before the activator.

15. The process of claim 1 wherein, prior to the screening reaction, a reactant and an activator are delivered to the polymerization mixture, the reactant being delivered after the activator.

16. The process of claim 1 wherein each metal-binding ligand has a coordination number (CN) independently selected from the group consisting of 1, 2, 3 and 4.

17. The process of claim 1 wherein each metal-binding ligand has a charge independently selected from the group consisting of 0, -1, -2 and -3.

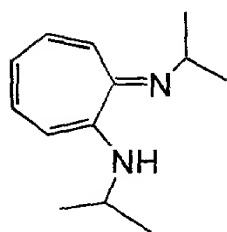
18. The process of claim 1 wherein each metal-binding ligand has a coordination number (CN) which is greater than its respective charge.

19. The process of claim 18 wherein each metal-binding ligand has a coordination number (CN) and a charge independently selected from the group consisting of:

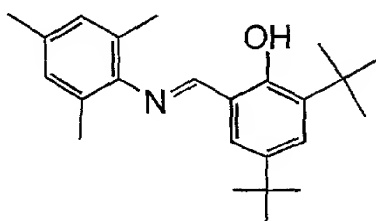
	<u>CN</u>	<u>Charge</u>
5	2	-2
	2	-1
	1	-1
	2	0
	3	-1
10	3	-2
	3	0
	4	0
	4	-1
	4	-2
15	1	0.

20. The process of claim 1 wherein each metal-binding ligand has a coordination number (CN) which is less than its respective charge.

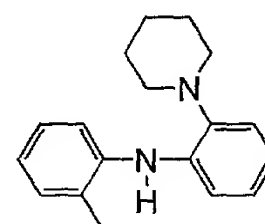
21. The process of claim 1 wherein each metal-binding ligand is independently selected from the group consisting of derivatives of the following:



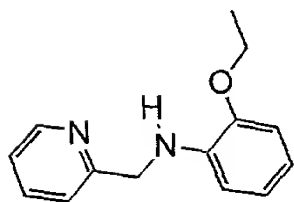
(2,-1)



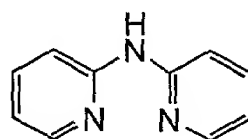
(2,-1)



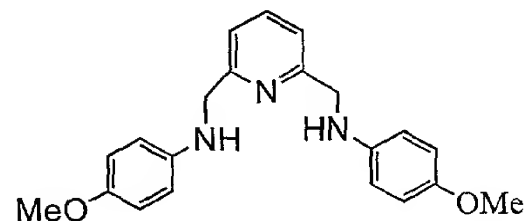
(2,-1)



(3,-1)



(3,-1)



(3,-2)

22. The process of claim 1 wherein the soluble metal precursor comprises a substituted alkyl solublizing ligand.

23. The process of claim 22 wherein the solublizing ligand is a trimethylsilyl-substituted alkyl.

24. The process of claim 22 wherein the solublizing ligand is selected from the group consisting of mono(trimethylsilyl)-methyl, bis(trimethylsilyl)methyl and tris(trimethylsilyl)-methyl.

25. The process of claim 1 wherein the soluble metal precursor comprises an alkoxy solublizing ligand.

26. The process of claim 25 wherein the solublizing ligand is tert-butoxy.

27. The process of claim 1 wherein the soluble metal precursor comprises an aryloxy solublizing ligand.

28. The process of claim 27 wherein the solublizing ligand is 2,6-bis(tert-butyl)phenoxy.

29. The process of claim 1 wherein the soluble metal precursor comprises an amino solublizing ligand.

30. The process of claim 29 wherein the solublizing ligand is N,N-bis(trimetylsilyl)amino or N,N-diethylamino.

31. The process of claim 1 wherein the soluble metal precursor comprises a 1,3-dionate solublizing ligand.

32. The process of claim 31 wherein the solublizing ligand is 2,2,6,6-tetramethyl-3,5-heptanedionate.

33. The process of claim 31 wherein the solublizing ligand is 2,4-pentanedionate.

34. The process of claim 1 wherein the soluble metal precursor comprises a carboxylate solublizing ligand.

35. The process of claim 34 wherein the solublizing ligand is trifluoroacetate.

36. The process of claim 1 wherein the soluble metal precursor comprises a substituted or unsubstituted cycloalkenyl solublizing ligand.

37. The process of claim 36 wherein the solublizing ligand is cyclopentadienyl.

38. The process of claim 1 wherein the soluble metal precursor has the formula  $MR_nL_m$ , wherein M is a transition metal, a lanthanide metal, an actinide metal, an alkali metal, an alkaline earth metal or a main group metal, R is a solublizing ligand, L is a neutral solublizing ligand, n ranges from about 0 to about 8, and m ranges from about 0 to about 6, provided the sum of  $n + m$  is at least 1, and further wherein said soluble metal precursor is negatively charged, and the metal precursor solution additionally comprising a counter cation.

39. The process of claim 1 wherein the soluble metal precursor has the formula  $LnR_3$ , wherein R is independently selected from the group consisting of halo, substituted or unsubstituted alkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, alkoxy, aryloxy, hydroxy, boryl, silyl, hydride, thio, seleno, phosphino, amino, carboxylate, dionate, oxalate, carbonate, nitrate, sulfate, perchlorate, sulfonate, phosphonate and combinations thereof, and wherein Ln is selected from the group consisting of La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu or a combination thereof.

40. The process of claim 1 wherein the soluble metal precursor comprises more than one solublizing ligand, each being the same.

41. The process of claim 40 wherein the solublizing ligand is selected from the group consisting of halo, hydride, substituted or unsubstituted alkyl, substituted or

unsubstituted cycloalkyl, substituted or unsubstituted  
5 aryl, substituted or unsubstituted heteroalkyl, alkoxy,  
aryloxy, dionate, carboxylate and amino.

42. The process of claim 1 wherein the soluble metal  
precursor has the formula  $MR_nL_m$ , wherein M is a transition  
metal, R is a solublizing ligand, L is a neutral solublizing  
ligand, n ranges from about 0 to 7, m ranges from about 1 to  
5 6, and n+m ranges from about 1 to 7.

43. The process of claim 1 wherein the soluble metal  
precursor has the formula  $MR_nL_m$ , wherein M is a lanthanide  
metal, R is a solublizing ligand, L is a neutral solublizing  
ligand, n ranges from about 0 to 7, m ranges from about 1 to  
5 6, and n+m ranges from about 1 to about 9.

44. The process of claim 1 wherein the soluble metal  
precursor has the formula  $M_pR_nL_{m'}$ , wherein M is a transition  
metal, R is a solublizing ligand, L is a neutral solublizing  
ligand, p is at least about 2, n' ranges from 0 to 7, m'  
5 ranges from 1 to 6, and n'+m' ranges from about 2 to about  
7.

45. The process of claim 1 wherein the soluble metal  
precursor has the formula  $M_pR_nL_{m'}$ , wherein M is a lanthanide  
metal, R is a solublizing ligand, L is a neutral solublizing  
ligand, p is at least about 2, n' ranges from 0 to 7, m'  
5 ranges from 1 to 6, and n'+m' ranges from about 2 to about  
9.

46. The process of claim 1 wherein the soluble metal  
precursor comprises one or more neutral solublizing ligands,  
L, independently selected from the group consisting of  
carbon monoxide, isocyanide, nitrous oxide, alkyl nitrile,  
5 aryl nitrile,  $PX_3$ ,  $NX_3$ ,  $OX_2$ ,  $SX_2$ ,  $SeX_2$ ,  $OPX_3$ ,  $ONX_3$ ,  $SPX_3$ ,  $OSX_2$ ,  
 $OSOX_2$ ,  $X_2N-NX_2$ ,  $XS-SX$ ,  $XO-OX$ ,  $\eta^6$ -arene, olefin, alkenyl,



cycloalkenyl, alkynyl and combinations thereof, wherein each X is independently selected from the group consisting of substituted or unsubstituted alkyl, substituted or  
10 unsubstituted cycloalkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, silyl and combinations thereof.

47. The process of claim 1 wherein prior to the polymerization reaction one or more of the polymerization mixtures is activated.

48. The process of claim 47 wherein activation is achieved by the addition of one or more activators independently selected from the group consisting of methylalumoxane, trialkylaluminum, dialkylaluminumhydride,  
5 diethylaluminummethoxide, diethylaluminumchloride, dibutylmagnesium, dialkylzinc, trialkylboron,  $\text{AgBF}_4$ ,  $\text{AgBPh}_4$ ,  $\text{NaBAR}_4$ ,  $\text{AgBAR}_4$ ,  $[\text{H}(\text{OEt}_2)]^+[\text{BAR}_4]^-$ ,  $[\text{H}(\text{OEt}_2)]^+[\text{B}(\text{C}_6\text{F}_5)_4]^-$ ,  $\text{B}(\text{C}_6\text{F}_5)_3$ ,  $\text{PhNMe}_2\text{HB}(\text{C}_6\text{F}_5)_4$  and  $\text{Ph}_3\text{CB}(\text{C}_6\text{F}_5)_4$ .

49. The process of claim 48 wherein the activator is methylalumoxane,  $\text{B}(\text{C}_6\text{F}_5)_3$ ,  $\text{PhNMe}_2\text{HB}(\text{C}_6\text{F}_5)_4$  or  $\text{Ph}_3\text{CB}(\text{C}_6\text{F}_5)_4$ .

50. The process of claim 48 wherein the trialkylaluminum is selected from the group consisting of trimethylaluminum, triethylaluminum and tri(isobutyl)aluminum.

51. The process of claim 48 wherein activation is achieved by the addition of a trialkylaluminum and  $\text{B}(\text{C}_6\text{F}_5)_3$ .

52. The process of claim 48 wherein activation is achieved by the addition of a trialkylaluminum and  $\text{PhNMe}_2\text{HB}(\text{C}_6\text{F}_5)_4$ .

53. The process of claim 1 wherein the soluble metal precursor has the general formula  $MR_n$ , wherein M is a metal atom selected from the group consisting of a transition metal, a lanthanide metal or a main group metal, R is one or  
5 more solublizing ligands selected from the group consisting of mesityl and 2,4-petanedionate, and n ranges from about 2 to about 3.

54. The process of claim 1 wherein one or more of the metal-ligand compositions is screened for homogeneous catalytic activity.

55. The process of claim 54 wherein one or more of the metal-ligand compositions is screened for homogeneous catalytic activity in an olefin polymerization reaction.

56. The process of claim 1 wherein the reaction product is screened for a property of interest selected from the group consisting of electrical, thermal, mechanical, morphological, optical, magnetic or chemical.

57. The process of claim 1 wherein the reaction product is screen for a property of interest by a method selected from the group consisting of infrared spectroscopy, infrared imaging, liquid chromatography, light scattering,  
5 polymer structural testing, polymer melt flow testing, polymer property testing, Fourier transform infrared spectroscopy, thin layer chromatography, solid phase staining, rapid gel permeation chromatography, nuclear magnetic resonance spectroscopy, depolarized light  
10 scattering, rapid thermal analysis, gas composition-mass spectrometry, thermal measurement, X-ray fluorescence, reactant consumption or reactant uptake, gravimetric measurement of product yield and liquid composition-mass spectrometry.

58. The process of claim 1 wherein the array comprises at least about 8 different ligands.

59. The process of claim 1 wherein the array comprises at least about 15 different ligands.

60. The process of claim 1 wherein the array comprises at least about 23 different ligands.

61. The process of claim 1 wherein the array comprises at least about 40 different ligands.

62. The process of claim 1 wherein the array comprises at least about 80 different ligands.

63. The process of claim 1 wherein the array comprises at least about 200 different ligands.

64. The process of claim 1 wherein the array comprises at least about 1000 different ligands.

65. The process of claim 1 wherein the soluble metal precursor has the formula  $ML$ ,  $MR_nL_m$  or  $M_pR_nL_m$ , wherein  $M$  is a metal,  $R$  is a solublizing ligand, and  $L$  is a neutral solublizing ligand.

66. The process of claim 65 wherein  $L$  is selected from the groups consisting of alkyl nitrile, cyclic olefin, bicyclic olefin, cycloalkenyl, bicycloalkenyl, alkynyl,  $\eta^6$ -arene, or a combination thereof.

67. The process of claim 66 wherein  $L$  is selected from the group consisting of acetonitrile, cyclooctene, norbornene, 1,5-cyclooctadiene, cycloheptatriene, cyclooctatetraene, norbornadiene,  $\eta^6$ -*p*-cymene, or a combination thereof.

68. The process of claim 1 wherein the soluble metal precursor is a dimer, a trimer, or higher order complex.

69. The process of claim 1 wherein the soluble metal precursor is selected from the group consisting of  
Ti(CH<sub>2</sub>Ph)<sub>4</sub>, Zr(CH<sub>2</sub>Ph)<sub>4</sub>, Hf(CH<sub>2</sub>Ph)<sub>4</sub>, V(mes)<sub>3</sub>(THF), Ta(CH<sub>3</sub>)<sub>3</sub>(Cl)<sub>2</sub>,  
Nb(CH<sub>3</sub>)<sub>3</sub>(Cl)<sub>2</sub>, Ta(NMe<sub>2</sub>)<sub>3</sub>(Cl)<sub>2</sub>, Cr[(CH(SiMe<sub>3</sub>)<sub>2</sub>)<sub>3</sub>,  
5 Cr(mesityl)<sub>2</sub>(THF), Cr(mesityl)<sub>2</sub>(THF)<sub>3</sub>, [Fe(mesityl)<sub>2</sub>]<sub>2</sub>,  
[Co(mesityl)<sub>2</sub>]<sub>2</sub>, Co(mesityl)<sub>3</sub>Li(THF)<sub>4</sub>, [Mn(mesityl)<sub>2</sub>]<sub>3</sub>,  
Cr(mesityl)<sub>3</sub>, Sc(CH(SiMe<sub>3</sub>)<sub>2</sub>)<sub>3</sub>, Y(CH(SiMe<sub>3</sub>)<sub>2</sub>)<sub>3</sub>, Ln(CH(SiMe<sub>3</sub>)<sub>2</sub>)<sub>3</sub>,  
Sc(O(2,6-(tBu)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>))<sub>3</sub>, Y(O(2,6-(tBu)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>))<sub>3</sub>, Ln(O(2,6-  
(tBu)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>))<sub>3</sub>, Sc(O(2,6-(tBu)<sub>2</sub>4-Me-C<sub>6</sub>H<sub>3</sub>))<sub>3</sub>, Y(O(2,6-(tBu)<sub>2</sub>4-Me-  
10 C<sub>6</sub>H<sub>3</sub>))<sub>3</sub>, Ln(O(2,6-(tBu)<sub>2</sub>4-Me-C<sub>6</sub>H<sub>3</sub>))<sub>3</sub>, Sc(N(SiMe<sub>3</sub>)<sub>2</sub>)<sub>3</sub>,  
Y(N(SiMe<sub>3</sub>)<sub>2</sub>)<sub>3</sub>, Ln(N(SiMe<sub>3</sub>)<sub>2</sub>)<sub>3</sub>, Ni(acac)<sub>2</sub>, Pd(acac)<sub>2</sub>, Co(acac)<sub>3</sub>,  
Fe(acac)<sub>3</sub>, Fe(acac)<sub>2</sub>, Mn(acac)<sub>2</sub>, Cr(acac)<sub>2</sub>, Cr(acac)<sub>3</sub>,  
V(acac)<sub>3</sub>, V(O)(acac)<sub>3</sub>, Ni(TFA)<sub>2</sub>, Fe(TFA)<sub>2</sub>, Fe(TFA)<sub>3</sub>, Co(TFA)<sub>2</sub>,  
Mn(TFA)<sub>2</sub>, [Cr(TFA)<sub>2</sub>]<sub>2</sub>, Cr(TFA)<sub>3</sub>, V(TFA)<sub>3</sub>, CrCl<sub>3</sub>(THF)<sub>3</sub>,  
15 VCl<sub>3</sub>(THF)<sub>3</sub>, (COD)PdMeCl, [(cyclooctene)PdMeCl]<sub>2</sub>,  
(COD)PdMeOTf, [(allyl)PdCl]<sub>2</sub>, ((CH<sub>3</sub>)<sub>3</sub>CN)<sub>2</sub>PdCl<sub>2</sub>, [(allyl)NiCl]<sub>2</sub>,  
[(CH<sub>3</sub>O<sub>2</sub>CC<sub>3</sub>H<sub>4</sub>)NiBr]<sub>2</sub>, [(allyl)NiTFA]<sub>2</sub>, (p-cymene)-  
Ru(TFA)<sub>2</sub>(CH<sub>3</sub>CN), (p-cymene)Ru(mesityl)(TFA), (PPh<sub>3</sub>)<sub>4</sub>RuH<sub>2</sub>,  
(PPh<sub>3</sub>)<sub>2</sub>Ni(Ph)Cl, (PPh<sub>3</sub>)<sub>4</sub>Ni, (COD)<sub>2</sub>Ni, (py)<sub>2</sub>Ni(CH<sub>2</sub>SiMe<sub>3</sub>)<sub>2</sub>,  
20 Fe(C(SiMe<sub>3</sub>)<sub>3</sub>)<sub>2</sub>, Co(C(SiMe<sub>3</sub>)<sub>3</sub>)<sub>2</sub>, Mn(C(SiMe<sub>3</sub>)<sub>3</sub>)<sub>2</sub>, Ti(CH<sub>2</sub>CMe<sub>3</sub>)<sub>4</sub>,  
Zr(CH<sub>2</sub>CMe<sub>3</sub>)<sub>4</sub>, Hf(CH<sub>2</sub>CMe<sub>3</sub>)<sub>4</sub>, TiCl<sub>4</sub>, Ti(NMe<sub>2</sub>)<sub>4</sub>, Zr(NMe<sub>2</sub>)<sub>4</sub>,  
Hf(NMe<sub>2</sub>)<sub>4</sub>, Zr(NEt<sub>2</sub>)<sub>4</sub>, Ti(NMe<sub>2</sub>)<sub>2</sub>Cl<sub>2</sub>, Zr(N(SiMe<sub>3</sub>)<sub>2</sub>)<sub>2</sub>Cl<sub>2</sub>,  
Hf(N(SiMe<sub>3</sub>)<sub>2</sub>)<sub>2</sub>Cl<sub>2</sub>, Zr(TFA)<sub>4</sub>, Hf(TFA)<sub>4</sub>, Ti(TFA)<sub>2</sub>Cl<sub>2</sub>, TiCl<sub>3</sub>(THF)<sub>3</sub>,  
V(CH(SiMe<sub>3</sub>)<sub>2</sub>)<sub>3</sub>(THF), V(O-2,6-iPr-C<sub>6</sub>H<sub>3</sub>)<sub>4</sub>Li(THF), Ta(NMe<sub>2</sub>)<sub>5</sub>,  
25 (TMEDA)NiMe<sub>2</sub>, (TMEDA)PdMe<sub>2</sub>, Ta(CH<sub>2</sub>CMe<sub>3</sub>)<sub>2</sub>Cl<sub>3</sub>, TaPh<sub>5</sub>,  
Co(Ph<sub>3</sub>P)<sub>3</sub>CH<sub>3</sub>, [Co(Ph<sub>3</sub>P)<sub>3</sub>H]<sub>2</sub>N<sub>2</sub>, and [Ni(PCy<sub>3</sub>)<sub>2</sub>]<sub>2</sub>N<sub>2</sub>, or a  
combination thereof, wherein Ln is selected from the group  
consisting of La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er,  
Tm, Yb, Lu or a combination thereof.

70. The process of claim 1 further comprising  
delivering a metal-binding ligand which is not bound to a

solid support to the plurality of discrete reaction vessels  
to form a metal-ligand composition, the ligand being  
5 combined with a deprotonating agent.

71. The process of claim 70 wherein the deprotonating  
agent is selected from the group consisting of  $\text{LiN}(\text{SiMe}_3)_2$ ,  
 $\text{NaN}(\text{SiMe}_3)_2$ ,  $\text{KN}(\text{SiMe}_3)_2$ ,  $\text{BuLi}$ , or  $\text{KCH}_2\text{Ph}$ .

72. The process of claim 1 wherein the soluble metal  
precursor is not bound to a solid support.

73. A process for preparing and screening an array of  
metal-ligand compositions comprising:

preparing an array of reaction mixtures in a series of  
discrete reaction vessels contained by or within an  
5 integrated structure, each reaction mixture of the array  
comprising, in a non-protic medium, a reactant for a  
chemical reaction of interest and a metal-ligand composition  
for catalyzing a chemical reaction in which the reactant  
participates wherein different reaction vessels of the array  
10 contain different metal-ligand compositions and said  
preparing comprises delivering a metal-binding ligand not  
bound to a solid material and a dissolved, soluble metal  
precursor to each of the reaction vessels of the array;  
subjecting the reaction mixture to conditions conducive  
15 to the formation of a reaction product; and  
screening the array for reaction product.

74. The process of claim 73 wherein the metal-ligand  
compositions comprise a cyclic structure having at least 5  
ring members, one member being the metal of the soluble  
metal precursor.

75. The process of claim 73 wherein the conditions  
conducive to the formation of a reaction product are  
selected from those suitable for carbonylation,

hydroformylation, hydroxycarbonylation, hydrocarbonylation,  
5 hydroesterification, hydrogenation, transfer hydrogenation,  
hydrosilylation, hydroboration, hydroamination, epoxidation,  
aziridination, reductive amination, aryl amination,  
polymerization, oligomerization, C-H activation-insertion,  
C-H activation-insertion, C-H activation-substitution, C-  
10 halogen activation, C-halogen activation-insertion, C-  
halogen activation-substitution, C-C coupling, C-N coupling,  
cyclopropanation, alkene metathesis and alkyne metathesis.

76. The process of claim 73 wherein the metal-ligand compositions comprise a cyclic structure having at least 5 ring members, one member being the metal of the soluble metal precursor.

77. The process of claim 73 wherein the metal-binding ligand is delivered to the series of discrete reaction vessels after the soluble metal precursor.

78. The process of claim 73 wherein the soluble metal precursor has a formula  $MR_n$ , wherein M is a transition metal, a lanthanide metal, an actinide metal, an alkali metal, an alkaline earth metal or a main group metal, R is a  
5 solublizing ligand, and n ranges from about 1 to about 8.

79. The process of claim 73 wherein the soluble metal precursor has a formula  $M_pR_nL_{m'}$ , wherein M is a transition metal, a lanthanide metal, an actinide metal, an alkali metal, an alkaline earth metal or a main group metal, R is a  
5 solublizing ligand, L is a neutral solublizing ligand, p is greater than 1, n' and m' are each independently a number greater than 0, provided the sum of n' + m' is at least 2.

80. The process of claim 73 wherein the soluble metal precursor comprises a metal selected from Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Y, Zr, Nb, Mo, Ru, Rh, Pd, Ag, Cd,

La, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Ce, Pr, Nd, Sm, Eu,  
5 Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, U, Th, B, Al, Ga, Tl, In,  
Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr, Ba, Ge, Sn, Pb, Sb, Bi or  
a combination thereof.

81. The process of claim 73 wherein the soluble metal  
precursor comprises one or more solublizing ligands  
independently selected from the group consisting of halogen,  
substituted or unsubstituted alkyl, substituted or  
5 unsubstituted cycloalkyl, substituted or unsubstituted  
cycloalkenyl, substituted or unsubstituted heteroalkyl,  
substituted or unsubstituted heterocycloalkyl, substituted  
or unsubstituted aryl, substituted or unsubstituted  
heteroaryl, alkoxy, aryloxy, hydroxy, boryl, silyl, hydride,  
10 thio, oxo, imido, sulfido, seleno, phosphino, amino,  
carboxylate, 1,3-dionate, oxalate, carbonate, nitrate,  
sulfate, perchlorate, sulfonate, phosphonate and  
combinations thereof.

82. The process of claim 73 wherein the soluble metal  
precursor comprises a solublizing ligand R and/or a neutral  
solublizing ligand L, and further wherein one or more of the  
metal-ligand compositions is formed without displacing one  
5 or more of the solublizing ligands and/or neutral  
solublizing ligands.

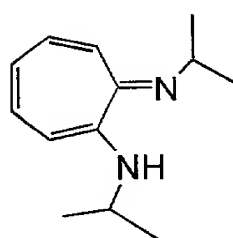
83. The process of claim 73 wherein the soluble metal  
precursor comprises a solublizing ligand R and/or a neutral  
solublizing ligand L, and further wherein formation of one  
or more of the metal-ligand compositions is accompanied by  
5 the displacement of one or more of the solublizing ligands  
and/or neutral solublizing ligands, said displaced ligand(s)  
not interfering with or significantly inhibiting the  
reaction.

84. The process of claim 83 wherein, prior to polymerization reaction, one or more of the metal-ligand compositions is treated to convert the displaced solublizing ligand, R, and/or the displaced neutral solublizing ligand, L, to a form which does not interfere or significantly inhibit the reaction.

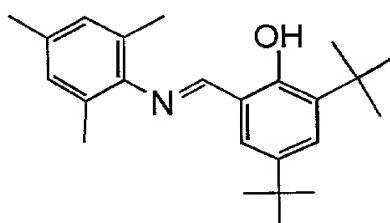
85. The process of claim 73 wherein each metal-binding ligand has a coordination number (CN) independently selected from the group consisting of 1, 2, 3 and 4.

86. The process of claim 85 wherein each metal-binding ligand has a charge independently selected from the group consisting of 0, -1, -2 and -3.

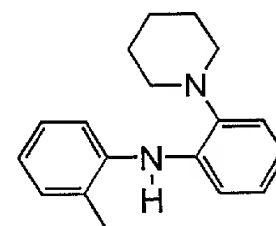
87. The process of claim 73 wherein each metal-binding ligand is independently selected from the group consisting of derivatives of the following:



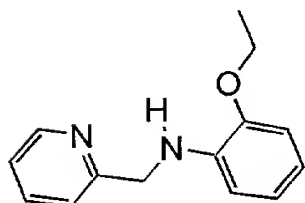
(2,-1)



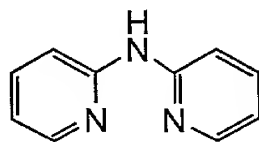
(2,-1)



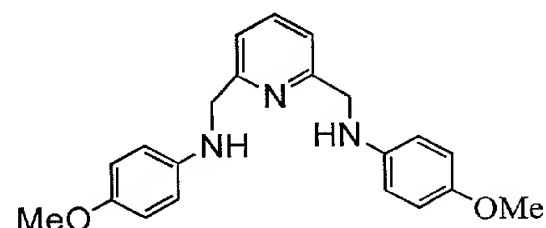
(2,-1)



(3,-1)



(3,-1)



(3,-2)



88. The process of claim 73 wherein the soluble metal precursor comprises more than one solublizing ligand, each being the same.

89. The process of claim 88 wherein the solublizing ligand is selected from the group consisting of halo, hydride, substituted or unsubstituted alkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted  
5 aryl, substituted or unsubstituted heteroalkyl, alkoxy, aryloxy, dionate, carboxylate and amino.